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FINAL TECHNICAL REPORT

ONR GRANT N00014-90J1177

Robert L. Smith and P. Michael Kosro, Principal Investigators GULF OF TEHUANTEPEC WIND-JET RESPONSE



The objective of this study was to observe the response of the upper ocean to the strong (greater than 20 knots) wind jet that intermittently blows seaward over the Gulf of Tehuantepec (Pacific coast of southern Mexico) during winter. The jet results from atmospheric high pressure systems over the Gulf of Mexico being confined by the Sierra Madre mountain range (2 km high and extending for over 1000 km); the largest pass in the mountain range is just inland from the Gulf of Tehuantepec. The wind jet (Tehuantepecano) lasts for several days and extends 300 km seaward from the coast.

In January 1989 we moored three upward looking Acoustic Doppler Current Profilers (ADCP) about 150 m below the surface in deep water 200 km offshore, across the across the axis of the expected wind-jet. This was done as part of an international experiment, in collaboration with oceanographers from the U. K. (University of Wales, Menai Bridge) and Mexico (CICESE, Ensenada). The U. K. oceanographers mapped a 300 by 300 km area using conventional and towed (Seasoar) CTD (conductivity, temperature, depth) instruments and shipborne ADCP. Wind recorders and thermistor chains were deployed near our ADCP moorings. The Mexican scientists made CTD surveys and moored current meters on the continental shelf.

The experiment was successful: One major wind event cycle occurred after mid-January when all moorings were in place. The wind increased from 2 to over 20 m/s within hours and remained strong for two days. The sea temperature dropped by 6C beneath the axis of or the wind jet as surface mixing intensifies and the pycnocline eroded. The temperature anomaly resulting from the wind-induced vertical mixing, observed in satellite SST images, extended nearly 400 km offshore. The ADCP instruments, moored across the axis of the wind-jet, recorded strong local accelerations in the surface layer (to speeds exceeding 1 m/s) near the center and the western edge of the jet. The moored ADCP array revealed rotation of the near-surface currents with time at the western mooring; this was consistent with the southwestward movement of an anti-cyclonic eddy seen in the SST imagery. At the central mooring, strong offshore flow occurred briefly with the wind-event and then reappeared as the anti-cyclonic eddy expanded. The warm-core eddy had a diameter of about 200 km. The mooring to the east of the wind jet revealed weaker and steadier flow throughout the experiment. Currents over the continental shelf showed alongshore convergence toward the head of the Gulf of Tehuantepec, feeding strong offshore flow near the center of the wind-jet.

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